

2.5 Reason Using Properties from Algebra

Let a, b, and c be real numbers.

Properties of Equality

Addition Property--If $a = b$ and $c = d$, then $a + c = b + d$.

Subtraction Property--If $a = b$ and $c = d$, then $a - c = b - d$.

Multiplication Property--If $a = b$, then $c \cdot a = c \cdot b$.

Division Property-- If $a = b$ and $c \neq 0$, then $\frac{a}{c} = \frac{b}{c}$

Distributive Property-- $a(b + c) = ab + ac$

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Substitution Property--If $a = b$, then either a or b may be substituted for the other in any equation.

Reflexive Property-- $a = a$

Symmetric Property--If $a = b$, then $b = a$.

Transitive Property--If $a = b$ and $b = c$, then $a = c$.

Reflexive, symmetric, and transitive also work with congruence.

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Example 1

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|----------------------------------|-----------------|
| 1. $8(x - 5) = 32$ | 1. Given |
| 2. $8x - 40 = 32$ | 2. Distributive |
| 3. $8x - 40 + 40 = 32 + 40$ | 3. Addition |
| 4. $8x = 72$ | 4. Substitution |
| 5. $\frac{8x}{8} = \frac{72}{8}$ | 5. Division |
| 6. $x = 9$ | 6. Substitution |

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Example 1

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|--------------------|-------------|
| 1. $8(x - 5) = 32$ | 1. Given |
| 2. $8x - 40 = 32$ | 2. Distrib. |
| 3. $8x = 72$ | 3. Addition |
| 4. $x = 9$ | 4. Division |

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Example 2

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|------------------|--------------------|
| 1. $5x - 3 = 12$ | 1. <u>Given</u> |
| 2. $5x = 15$ | 2. <u>Addition</u> |
| 3. $x = 3$ | 3. <u>Division</u> |

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Example 3

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|-----------------------|------------------|
| 1. $8x + 3x - 9 = 24$ | 1. <u>Given</u> |
| 2. $11x - 9 = 24$ | 2. <u>Subst.</u> |
| 3. $11x = 33$ | 3. <u>Add</u> |
| 4. $x = 3$ | 4. <u>Div</u> |

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Example 4

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|--------------------------------|------------------|
| 1. $2(5 - 3x) - 4(x + 7) = 92$ | 1. <u>Given</u> |
| 2. $10 - 6x - 4x - 28 = 92$ | 2. <u>Distr.</u> |
| 3. $-10x - 18 = 92$ | 3. <u>Subst.</u> |
| 4. $-10x = 110$ | 4. <u>Add</u> |
| 5. $x = -11$ | 5. <u>Div</u> |
| 6. $-11 = x$ | 6. <u>Symm.</u> |

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Justify each statement.

- | | |
|----------------------|---|
| 1. <u>Reflexive</u> | $m\angle 1 = m\angle 1$ |
| 2. <u>Addition</u> | If $m\angle 1 = m\angle 2$, then $m\angle 1 + m\angle 3 = m\angle 2 + m\angle 3$ |
| 3. <u>Mult.</u> | If $AB = CD$, then $2 \cdot AB = 2 \cdot CD$. |
| 4. <u>Symmetric</u> | If $RS = XY$, then $XY = RS$ |
| 5. <u>Transitive</u> | If $m\angle A = m\angle B$, and $m\angle B = m\angle C$, then $m\angle A = m\angle C$ |
| 6. <u>Division</u> | If $2 \cdot m\angle 1 = 90$, then $m\angle 1 = 45$ |
| 7. <u>Subst.</u> | If $m\angle 9 + m\angle 10 = 150^\circ$, and the $m\angle 10 = 48^\circ$, then $m\angle 9 + 48 = 150$. |
| 8. <u>Substn.</u> | If $m\angle 9 + 48 = 150$, then $m\angle 9 = 102$. |

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State the property that justifies each statement.

4. If $2x = 5$, then $x = \frac{5}{2}$

5. If $\frac{x}{2} = 7$, then $x = 14$.

6. If $x = 5$ and $b = 5$, then $x = b$.

7. If $XY - AB = WZ - AB$, then $XY = WZ$.

8. Solve $\frac{x}{2} + 4x - 7 = 11$. List the property that justifies each step.

9. Complete the following proof.

Given: $5 - \frac{2}{3}x = 1$

Prove: $x = 6$

Proof:

Statements	Reasons
a. $?$ <i>$5 - \frac{2}{3}x = 1$</i>	a. Given
b. $3(5 - \frac{2}{3}x) = 3(1)$	b. $?$ <i>Mult</i>
c. $15 - 2x = 3$	c. $?$ <i>Dist / Subst</i>
d. $?$ <i>$-2x = -12$</i>	d. Subtraction Prop.
e. $x = 6$	e. $?$ <i>Div</i>

Hw

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